THE ADVOCATE OF SCIENCE.

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THE ADVOCATE OF SCIENCE—VOLUME SECOND.

few numbers back we intimated an intention of changing the form of Advocate, at the conclusion of the present volume. We will now pro- to state what those alterations will be.

om a semimonthly, we purpose to make it a monthly journal of forty- large octavo pages to a number.

e popular style of its essays will not be altered, but further illustrated eans of wood cuts.

essays will not be confined to any particular subjects, but will em- e all connected with the sciences; such as Zoology, Comparative omy, Conchology, Botany, Geology, Mineralogy, Chemistry, Me- logy, Agriculture &c. &c. Arrangements have been made to pro- suitable popular contributions on all those subjects, illustrated with es.

itical notices on literature, and concise reviews of new scientific works periodicals will also be given. In this latter particular we shall pur- course strictly compatible with justice, praising none whose merits ubtful, and censuring only where the interest of science demands it.

e essays on Geology which have appeared in the present volume will epublished, with such additions and improvements as may suggest selves to the author. It has been intimated to us that this would e acceptable to our readers, particularly on account of the diagrams h will accompany them.

ith these additions and improvements, the subscription price will be d to two dollars a year. Its title will be modified or changed, should onclude on the propriety of a change. The work will be decidedly the est of the kind in the United States or Europe. The execution will ual, if not superior, to that of any similar American publication, and ular care will be taken to give correct illustrations, for which purpose rate artists will be employed.

ally, we would remind our friends that to accomplish this important t, it is necessary for them to cooperate with us in procuring additional ribers; not less than 2,000 will bear us out in the undertaking. And believe it will be to their interest as well as to our own, to have a l conducted in this manner,—of which kind there is none in the d States,—we hope no exertions will be spared, on their part, to pro- the execution of our design.

the agricultural portion of the community, we would particularly urge propriety of being interested in our scheme. For too frequently do we e operations of the farmer conducted without a due regard to that eco- which science would teach, and too often are his designs frustrated, is hopes disappointed, for want of the knowledge of a few simple ific principles.

e first number of the work will appear in the course of one or two s, and will serve as a partial specimen of its future character. It e proper to state, that unless the number of subscribers previously ned be obtained, our limited patronage will prevent us from giving posed embellishments.

are aware that the great irregularity which has heretofore attended blication, has been of considerable disadvantage to it. But we have contend with more than the ordinary difficulties which are incident execution of new periodicals; and as often as punctuality has been ed, with the hope that these difficulties were at an end, so often have structions appeared, which nothing but experience can enable an to provide against. And with what we have already learned, we ently believe it will not be flattering our patrons with an expectation will never be realized, were we to say that our new publication will ed at the commencement of every month.

EXPERIMENTS ON THE SIGHT AND SMELL OE VULTURES.

By Dr. J. Bachman of Charleston S. C.

(*Continued from page* 177.)

On the 16th of December 1833, I commenced a series of experiments on the habits of our vultures which I continued till the end of the month, and these have been renewed at intervals till the 15th of January 1834. Written invitations were sent to all the professors of the two medical colleges in this city to the officers and some of the members of the Philosophical Society and such other individuals as we believed might take an interest in the subject. Although Mr. Audubon was present during most of this time, and was willing to render any assistance required of him, yet he desired that we might adopt any mode that the ingenuity or experience of others could suggest, for arriving at the most correct conclusions. The manner in which these experiments were made, together with the results, I now proceed to detail.

There are two points in particular on which the veracity of Audubon has been assailed; 1st, whether the vultures feed on fresh or putrid flesh; and 2d, whether they are attracted to their food by the eye or the scent.

On the first head it was unnecessary to make many experiments, it being a subject with which the most casual observer amongst us is well acquainted. It is well known that the roof of our market house is covered with these birds every morning, waiting for any little scrap of fresh meat that may be thrown to them by the butchers. At our slaughter pens the offal is quickly devoured by our vultures whilst it is yet warm from the recent death of the slain animal. I have seen the vulture Aura a hundred miles in the interior of this country where he may be said to be altogether in a state of nature, regaling himself on the entrails of a deer which had been killed not an hour before. Two years ago, Mr. Henry Ward who is now in London and who was in the employ of the Philosophical Society of this city, was in the habit of depositing at the foot of my garden, in the suburbs of Charleston, the fresh carcases of the birds he had skinned. and in the course of half an hour both species of vulture, and particularly the turkey buzzard came and devoured the whole. Nay, we discovered that vultures feed on the bodies of their own species that had been thus exposed. A few days ago a vulture that had been killed by some boys in the neighborhood, and that had fallen near the place where we were performing our experiments, attracted on the following morning the sight of a turkey buzzard who commenced pulling off its feathers and feeding upon it. This brought down two of the black vultures who joined him in the repast. In this instance the former chased away the two latter to some distance, an unusual occurrence, as the black vulture is the strongest bird and generally keeps off the other species. We had the dead bird lightly covered with some rice chaff where it still remains undiscovered by the vultures.

2d. Whether is the vulture attracted to its food by the sense of smell or of sight? A number of experiments were tried to satisfy us on this head and all lead to the same result. A few of these I proceed to detail.

1st. A dead hare, (Lepus *timidus*,) a pheasant, (Phasianus *colchicus*) a kestrel, (Falco *tinnunculus* (*Linn.*) from a recent importation from Europe, together with a wheel barrow full of offal from the slaughter pens, were deposited on the ground at the foot of my garden. A frame was raised above it at the distance of twelve inches from the earth; this was covered with

brush wood, allowing the air to pass freely beneath it so as to convey the effluvium far and wide; and although thirty days have now gone by and the flesh has become offensive, not a single vulture appears to have observed it, though hundreds passed over it and some very near it in search of their daily food. Although the vultures did not discover this dainty mess, the dogs in the vicinity who appeared to have better olfactory nerves, frequently visited the place and gave us much trouble in the prosecution of our experiments.

2d. I now suggested an experiment which would enable us to test the inquiry whether the vulture could be attracted to an object by the sight alone. A coarse painting was made representing a sheep skinned and cut open. This proved very amusing—no sooner was this picture placed on the ground than the vultures observed it, alighted near, walked over it and some of them commenced tugging at the painting. They seemed much disappointed and surprised, and after having satisfied their curiosity flew away. This experiment was repeated more than fifty times with the same result. The painting was then placed within ten feet of the place where the offal was deposited;—they came as usual, walked around it, but in no instance evinced the slightest symptoms of their having scented the offal which was so near them.

3d. The most offensive portions of the offal were now placed on the earth; these were covered over by a thin canvass cloth, and on this were strewed several small pieces of fresh beef; the vultures came and ate the flesh that was in sight, and although they were standing on a quantity beneath, and their bills were frequently within the eighth of an inch of this putrid matter, they did not discover it. We made a small rent in the canvass and they at once discovered the flesh and began to devour it. We drove them away, replaced the canvass with a piece, that was entire; again they commenced eating the fresh pieces exhibited to their view, without discovering the hidden food they were trampling upon.

4th. The medical gentlemen who were present made a number of experiments to test the absurdity of a story widely circulated in the United States through the newspapers, that the eye of a vulture when perforated and the sight extinguished, would in a few moments be restored in consequence of his placing his head under his wing, the down of which was said to renew the sight. The eyes were perforated; I need not add that although they were refilled and had the appearance of rotundity, yet the bird became blind, and that it was beyond the power of the healing art to restore his lost sight. His life was however preserved, by occasionally putting food in his mouth. In this situation they placed him in a small out-house, hung the flesh of the hare (which had now become offensive) within his reach, nay they frequently placed it within an inch of his nostrils, but the bird gave no evidence of any knowledge that his favorite food was near him. This was repeated from time to time during an interval of twenty-four days (the period he survived the operation) with the same results.

We were not aware that any other experiments could be made to enable us to arrive at more satisfactory conclusions, and as we found if prolonged, they might become offensive to the neighbors, we abandoned them.

As my humble name can scarcely be known to many of those into whose hands this communication may fall, I have thought proper to obtain the signatures of some of the gentlemen who aided me in, or witnessed these experiments; and I must also add that there was not an individual among the crowd of persons who came to judge for themselves, who did not coincide with those who have given their signatures to this certificate.

We the subscribers having witnessed the experiments made on the habits of the vultures of Carolina (CATHARTES *aura* and CATHARTES *atratus*) commonly called turkey buzzard and carrion crow, feel assured that they devour fresh as well as putrid food of any kind, and that they are guided to their food a gether through their sense of sight, and not that of smell.

ROBERT HENRY A. M. *Pres. of the S. C*
JOHN WAGNER M. D. *Prof. of Surgery Col. of S. C.*
HENRY R. FROST M. D. *Prof. of Mat. M Med. Col. of S. C.*
C. F. LEITNER, M. D. *lecturer on B and Nat. History.*
B. B. STROBEL. M. D.
MARTIN STROBEL.

To be concluded in our next.)

GENERAL CHARACTER AND FUNERAL RITES OF THE NATCHEZ INDIANS.

(From Nuttall's Travels into the Arkansas.)

We see nothing, says Charlevoix, in their outward app ance that distinguishes them from the other savages of Canada Louisiana. They seldom made war, living in quiet posses of their country, and having no ambition to distinguish th selves by conquering their neighbors. Their despotic for government, accompanied by some taste for parade and co magnificence, and the great servility of their subjects, appe to be the shadow of a departing power and concomitant p lation, such as had been unparalleled in the history o northern natives.

Their great chief pretended to derive his origin from th which was likewise the principal object of their adoration was always chosen from the family of the nearest female tive of his predecessor, and his mother was also invested considerable power, and considered as an auxiliary chief. no less than the Great Sun, dispensed with the lives and ties of their subjects. The lesser chiefs and the people approached them without uttering three salutations in a and mournful tone, which it was necessary to repeat o tiring, and also to walk out from their presence backwar Even when they happened to meet them, they were oblig arrange themselves on either side of the path, and to r the customary salutation as they passed. Their subjects wise brought them the best of their harvest, of their hu and their fishing. And no person, not even their nearest tives, or those of noble families, when invited to eat with had a right to put their hand to the same dish, or to dri of the same vessel.

Every morning, as the sun appeared, the great chief ca the door of his cabin, and turning himself towards the bowed to the earth, and howled three successive times. dedicated to this purpose was then brought to him, out of he smoked tobacco, blowing the fume towards the sun, a other three quarters of the world.

The actions of the Great Chief were allowed to be w impeachment; and his life, according to an ancient and s compact, could never become forfeited by his crimes. the death of the Great Sun was considered the greate tional calamity which could happen, and superstitio brought it to be considered as an omen of the cessation o theocracy, and of the destruction of the world. Thei were termed nobles, an honor which was likewise attain the meritorious of inferior rank. The common people l under a degrading appellation, not indeed very different the French epithet of *canaille*, or our own term the mob vulgar. They carried this distinction even into their lan as there were different modes of addressing the vulg nobles.

When either the male or female sun died, all their *all* intimate attendants, devoted themselves to death, under suasion that their presence would be necessary to maint dignity of their chief in the future world. The wives a bands of these chiefs were likewise immolated for the sa pose, and considered it the most honorable and desir

maths. More than a hundred victims were sometimes sacrificed to the manes of the Great Chief. The same horrible ceremonies, in a more limited degree, were also exercised at the death of the lesser chiefs.

At the death of one of their female chiefs, Charlevoix relates that her husband not being noble was, according to their custom, strangled by the hands of his own son. Soon after, the body deceased being laid out in state, were surrounded by the dead bodies of twelve infants, strangled by the order of the eldest daughter of the late female chief, and who had now succeeded to her dignity. Fourteen other individuals were also prepared to die and accompany the deceased. On the day of interment, as the procession advanced, the fathers and mothers who had sacrificed their children, preceding the bier, threw the bodies upon the ground at different distances, in order that they might be trampled upon by the bearers of the dead. The corpse arriving in the temple where it was to be interred, the fourteen victims now prepared themselves for death by swallowing pills of tobacco and water, and were then strangled by the relations of the deceased, and their bodies cast into the common grave, and covered with earth.

The Natchez, together with the remains of the Grigras and Thioux, who had become incorporated with them, did not, in 1720, amount to more than 1200 warriors. Only six or seven years prior to this period, their warriors were estimated at 4000. This rapid decrease they attributed to the prevalence of contagious diseases, by which they had been wasted, for it does not appear that they were ever addicted to war, having long lived in peace with the neighboring nations, who venerated their sacred institutions, and acknowledged their political ascendancy and power. Their dominion once extended from the borders of bayou Mancha to the banks of the Ohio, and they numbered not less than 500 suns or caziques. Descended from, and confederated with them, were the Taensas of the Mobile, and the Chetimashas of bayou Placquemine, remnants of whom still exist, not far from the sites where they were first found by the French colonists, and against whom they waged an unsuccessful war.

The Natchez had a distinct tradition of migrating to the Mississippi, from the coast of the Gulf of Mexico, at two distinct periods of time. A part of the nation (probably about the period of the first establishment of the Mexican monarchy) fled from the threatening oppression of their natural enemies, and living in undisturbed tranquillity for several generations in their newly acquired territory, they became very populous, and were only joined by the Great Sun after the arrival and invasion of the Spaniards, with whom at first they had entered into an alliance. As to their ultimate oriental origin, it appears to be merely connected with their presumption of a descent from the sun, which first illuminates the eastern hemisphere. It was this superstition which proved so fatal to the Mexicans, who venerated as a celestial race the Spanish conquerors, because they had arrived from the region of the rising sun. Traces of the natural worship of the two great luminaries of day and night, were every where visible throughout the regions of the new world, and continue to be practised by those who are still unbiassed by the influence of the European nations. The Hurons, no less than the Muyscas of the plain of Bogota, in the equatorial regions, personified the moon in their female deity, Atahentsic, who was the mother of the fratricide Jonskeka, or the sun, betwixt whom were divided the powers of good and evil, the moon possessing the attributes of Hecate, and the sun those of Phœbus, Apollo, or Osiris the brother of Isis, or the moon.

Lucifer Matches.—The following mode of making these is very simple, and much less dangerous than other plans in use:—Take of chlorate of potash twelve parts, sulphuret of antimony four parts, animal glue or gum tragacanth three parts, and as much water as will suffice to bring the mixture to the consistence of a thick paste. The sulphuret of antimony is to be pulverised first, and the water with the glue or gum in solution added to it and well incorporated, when the chlorate of potash is to be gradually added. The antimony and chlorate must never be rubbed together in a dry state, as an explosion would be the result. The matches which are to be plunged in this paste, should be previously dipped about six or eight lines of their length into melted sulphur. The paper which is used to inflame them, is made by coating strong paper with fish glue, and covering this with a layer of very finely pulverised glass.

Memorial Encyclop.

THE COMMON ROOK—Corvus *frugilegus*.

From "the Journal of a Naturalist."

Gesner has called the common rook (Corvus *frugi'egus*) a corn-eating bird. Linnæus has somewhat lightened this epithet by considering it only as a gatherer of corn; to neither of which names do I believe it entitled, as it appears to live solely upon grubs, various insects and worms. It has at times great difficulty to support its life, for in a dry spring or summer most of these are hidden in the earth beyond its reach, except at those uncertain periods when the grub of the chaffer is to be found; and in a hot day we see the poor birds perambulating the fields, and wandering by the sides of the highways, seeking for, and feeding upon grasshoppers, or any casual nourishment that may be found. At those times, was it not for its breakfast of dew-worms, which it catches in the gray of the morning, as it is appointed the earliest of risers, it would commonly be famished. In the hot summer of 1825, many of the young brood of the season perished from want; the mornings were without dew, and consequently few or no worms were to be obtained; and we found them dead under the trees, having expired on their roostings. It was particularly distressing, for no relief could be given, to hear the constant clamor and importunity of the young for food. The old birds seemed to suffer without complaint; but the wants of their offspring were expressed by the unceasing cry of hunger, and pursuit of the parents for supply, and our fields were scenes of daily restlessness and lament. Yet, amid all this distress, it was pleasing to observe the perseverance of the old birds in the endeavor to relieve their famishing families, as many of them remained out searching for food quite in the dusk, and returned to their roosts long after the usual period for retiring. In this extremity it becomes a plunderer, to which by inclination it is not much addicted, and resorts to our newly-set potato-fields, digging out the cuttings. Ranks are seen sadly defective, the result of its labors, I fear; and the request of my neighbors now and then for a bird from my rookery, to hang up in *terrorem* in their fields, is confirmatory of its bad name. In autumn, a ripe pear, or a walnut, becomes an irresistible temptation, and it will occasionally obtain a good share of these fruits. In hard frost, it is pinched again, visits for food the banks of streams, and in conjunction with its congener the "villain crow," becomes a wayfaring bird, and seeks a dole from every passing steed. Its life, however, is not always dark and sombre: it has its periods of festivity also. When the waters retire from meadows and low lands, where they have remained any time, a luxurious banquet is provided for this corvus, in the multitude of worms which it finds drowned on them. But its jubilee is the season of the cockchaffer (Melolantha *vulgaris*) when every little copse, every oak, becomes animated with it and all its noisy, joyful family, feeding and scrambling for the insect food. The power or faculty, be it by the scent, or by other means, that rooks possess of discovering their food, is very remarkable. I have often observed them alight on a pasture of uniform verdure, and exhibiting no sensible appearance of withering or decay, and immediately commence stocking up the ground. Upon investigating the object of their operations, I have found many heads of plantains, the little autumnal dandelions, and other plants, drawn out of the ground and scattered about, their roots having been eaten off by a grub, leaving only a crown of leaves

upon the surface. This grub beneath, in the earth, the rooks had detected in their flight, and descended to feed on it, first pulling up the plant which concealed it, and then drawing the larvæ from their holes. By what intimation this bird had discovered its hidden food we are at a loss to conjecture; but the rook has always been supposed to scent matters with great discrimination.

It is but simple justice to these often censured birds, to mention the service that they at times perform for us in our pasture lands. There is no plant that I endeavor to root out with more persistency in these places than the turfy hair-grass (AIRA *cæspitosa.*) It abounds in all the colder parts of our grass lands, increasing greatly when undisturbed, and worthless itself, overpowers its more valuable neighbors. The larger turfs we pretty well get rid of; but multitudes of small roots are so interwoven with the pasture herbage, that we cannot separate them without injury; and these our. persevering rooks stock up for us in such quantities, that in some seasons the fields are strewed with the eradicated plants. The whole so torn up does not exclusively prove to be the hair-grass, but infinitely the larger portion consists of this injurious plant. The object of the bird in performing this service for us is to obtain the larvæ of several species of insects, underground feeders, that prey on the roots, as Linnæus long ago observed upon the subject of the little nard grass, (NARDUS *stricta.*) This benefit is partly a joint operation: the grub eats the root, but not often so effectually as to destroy the plant, which easily roots itself anew; but the rook finishes the affair by pulling it up to get at the larvæ, and thus prevents all vegetation; nor do I believe that the bird ever removes a specimen that has not already been eaten, or commenced upon by the caterpillar.

The rook entices its young from the breeding trees, as soon as they can flutter to any other. These young for a few evenings after their flight, will return with their parents, and roost where they were bred; but they soon quit their abode, and remain absent the whole of the summer months. As soon however as the heat of summer is subdued, and the air of autumn felt, they return and visit their forsaken habitations, and some few of them even commence the repair of their shattered nests; but this meeting is very differently conducted from that in the spring; their voices have now a mellowness approaching to musical, with little admixture of that harsh and noisy contention, so distracting at the former season, and it seems more like a grave consultation upon future procedure; and as winter approaches they depart for some other place. The object of this meeting is unknown; nor are we aware that any other bird revisits the nest it has once forsaken. Domestic fowls, indeed, make use of their old nests; but this is never, or only occasionally done by birds in a wild state. The daw and rock pigeon will build in society with their separate kindred: and the former even revisits in autumn the places it has nestled in. But such situations as these birds, require the ruined castle, abbey, or church tower, ledge in the rock &c. are not universally found and are apparently occupied from necessity. The rooks appear to associate from preference to society, as trees are common every where; but what motive they can have in view in lingering thus for a few autumnal mornings and counselling with each other around their abandoned and now useless nests, which before the return of spring are generally beaten from the trees, is by no means manifest to us.

The sense of smelling seems often to supply in animals the want of faculties they are not gifted with; and it is this power which directs them to their food with greater certainty, than the discernment of man could do. That we have every faculty given us necessary for the condition in which we are placed, is manifest; yet the mechanical talents and intuition of the insect, the powers that birds and beasts possess, and the superior acuteness of some of their senses, of which, perhaps, we have little conception, makes it evident that all creat things were equally the object of their Maker's benevolen and care; the worm that creepeth, and the beast that perishe deserve our consideration, and claim from human reason me cy and compassion.

THE ADVOCATE OF SCIENCE.

Second Month 20, 1834.

Errata. In the heading of the notice of locusts in our last number, t specific name was inadvertently printed "*septemdicum*" instead of bei *septemdecim*. In the article on "Screw drivers," the last word of the la sentence but one, should be *length*, instead of "weight."

TO READERS AND CORRESPONDENTS.

The interesting communication of "L. H. P." given in another colum will probably claim the attention of our correspondent "Junius."

Our readers will observe that our correspondent "H. G." has comple with our request, and sent us such a summary of the weather as we desire The snows are included in the summary from the hospital; and in justic to that summary we must state, that we have been informed the deficienc which have occurred from the cause stated in our last, have always bee compensated by the guage belonging to the Board of Health. Includin all these things our readers will observe, an additional quantity of 4.48 inches a year to be added to the summary from Wilmington, thus makin the average for the last five years 56.124. Hence the excess of rai which has fallen in Wilmington over that which has fallen in Philade phia has been 12.268 inches a year. At the time we expressed our doub of the correctness of one of those statements, we took into considerati local rains; but presumed the account between the two places would b balanced, or nearly so, by those which occurred in Philadelphia, and whic did not extend to Wilmington. The locality of Wilmington it is true, i more favorable for local rains than this city. But we had no idea that th difference was so great.

THE MOON HAVING TO TRAVERSE A RESISTING MEDIUM.

The essay of our worthy correspondent, "L. H. P.," in the last numbe of the Advocate, although it manifests not a little ingenuity, has not satisfied us of the danger that exists in regard to the threatened visit of the moon. We shall give our reasons for holding to the opinions previously expressed by us.

In the first place we protest against his demurrer to the demonstrations of La Place. We have an implicit reliance on all the conclusions of that great astronomer, which are the result of mathematical calculations—one of which, as we have already said, refers the approximation of the moon and earth to an irregularity in the moon's motion, consequent on the relative position of the heavenly bodies. This irregularity has a period of some thousands of years, when the relative position will change so as to cause the moon to recede from the earth and counterbalance the present approximation. La Place has detected many similar irregularities in the movements of the heavenly bodies, varying in their periods from a few months, to more than 20,000 years; and so far as time has tested the truth of his calculations, they have proved to be correct. He has thus disproved the hypothesis of Newton, that the solar system contains within itself the seeds of its own destruction—an hypothesis founded on the observation of the irregularities alluded to, one of which is the constant approximation of the moon to the earth for some thousands of years past.

L. H. P. asks if the advocates of the materiality of light and heat can avoid the conclusion that the motion of the moon is somewhat impeded by these substances. Though we do not assert that light and heat are material, yet we cannot see the force of the argument upon those who hold that opinion. With our present imperfect knowledge of the nature and properties of matter, we are not prepared to admit that all material substances, in every modification of their existence, must oppose a mechanical force to the passage of bodies. The electric fluid, for instance, is supposed to be

material; and yet, it does not conform to our common notions of its properties, to presume that it offers a mechanical resistance to the motion of any solid mass.

But the main point on which we differ from our correspondent is whether or not the atmosphere is *infinitely elastic.* If it is, we must yield the argument; for then it is evident that the earth's atmosphere extends throughout all space, and resists, more or less, the motion of the moon and other heavenly bodies.

Now, we believe that the elasticity of the air is not infinite—that it has a limit, and that this limit prevents it from being diffused through space, or extended beyond a certain distance from the earth.

Of the cause of the elasticity of the air, we know nothing. We are not informed whether the particles of the fluid actually possess this property, or whether it is a result of the caloric which exists in the fluid. Newton supposed the particles not elastic in themselves, but tending to separate from each other on account of some cause of repulsion between them; this cause he believed to be caloric. The question is whether a single atom of air, (supposing the particles to be themselves elastic,) is capable of expanding itself so as to fill the universe, provided all counteracting agency were removed; or whether, supposing elasticity to depend on repulsion, the repulsive power of two particles would be sufficient to drive them to the opposite ends of space, (excuse the expression,) and thus to overcome the attraction of gravitation. We prefer the supposition of a limit to the expansibility of the atmosphereric particle, or to the repulsive force of two or more particles on each other.

The opinion which we have already advanced is, that the atmosphere becomes more and more attenuated as we recede from the earth, until finally it is not capable of greater attenuation; and that the ærial particles composing the highest stratum, are kept in their place by the attraction of gravitation, their elasticity being exhausted, or carried to its utmost limit. And therefore that the moon suffers no impediment to her progress from the extension of the earth's atmosphere to her orbit.

True, the force of gravity decreases rapidly as we ascend; but the density of the air decreases much more rapidly, and approaches its extreme degree of attenuation with a corresponding rapidity. According to strict mathematical computation, the small body of air which a person can hold in his mouth, if carried to the height of little more than 100 miles, would then expand itself so as to occupy a space as large as our globe!

We should be pleased to hear again from L. H. P. on this or any subject.

PHOSPHORESCENCE OF THE OCEAN.

(From "Reminiscences of a Voyage to India." By Dr. Reynall Coates.)

As the glow worm and the fire fly enliven the night by land, so do many of the molluscæ and other marine animals kindle their mimic fires by sea but on a far grander and more imposing scale.

If during a dark night we watch attentively the advance and retreat of the breakers on the beach, we shall generally perceive the crest of each billow to be illuminated by a faint flash at the moment of its fall; and after the wave subsides, the beach will be spangled with minute but brilliant specs, which shine for a few moments and then disappear. These lights will convey an idea of what is meant by the phosphorescence of the ocean.

At all times, and in nearly all situations, the spray thrown up by the bow of the vessel is thickly strewed during the night with little silvery stars, that dance and whirl about among the eddies until they are lost in the distance. These luminous particles are generally so small that they are caught with difficulty, and so perfectly transparent, that they can scarcely be distinguished from the drops of brine adhering to the net. Their own radiance, by which they are visible in their native element, is soon lost when brought into the air, for it ceases instantly on the death of the animal. The few specimens which I have examined were either gelatinous molluscæ or microscopic shrimps; the former being luminous throughout their entire substance, and the latter, like the glow worm, emitting an intermittent light from a lantern near the tail.

Such were the appearances noticed in most parts of the North Atlantic Ocean, excepting the Gulf stream. The fretful waves of this region, vexed as it is by perpetual squalls, appear to be wrapped in total darkness. But in the tropical regions, and throughout the vast expanse of the Southern and Indian Oceans, the grandeur and sublimity of the night scene were often beyond description. The vivid hues of "the double headed shot clouds," which rise like immense mountains from the water of the western horizon, seemed to fade into twilight only to give place to a still more beautiful illumination in the bosom of the waves. The bow of the vessel scattered far around a blaze of light, which shone brilliantly under the brightest moon, and was often sufficiently intense to enable us to read upon the deck. Leaning over the stern, our track resembled a vast trough of fire, studded with innumerable floating lanterns and stars, such as fall from an exploding sky rocket. In the eddies, the whirling of these bodies produced long streams of light like serpents drawn in flame, and occasionally immense globes of fire would roll along beneath the keel, at the depth of several fathoms; yet so intensely bright that the little rudder fish were distinctly visible sporting beneath the cabin windows. These globes are generally as large as a flour barrel, and according to Peron and Lesuer, they are sometimes seen to reach the enormous diameter of twenty feet. I had once the gratification to observe one of these animals within a foot of the surface. It was a medusa, large enough to fill a bushel basket, visible in every fibre by its own illumination.

At these times the crest of every wave resembles a long line of ignited phosphorus, and every dip of the oar, or plunge of the bucket, produces a flash of light, and scatters scintillations on every side. Even the larger fish, when they approach the vessel, are followed by a luminous path like the tail of a comet, and they are often struck with the harpoon, guided by this appearance alone.

The sea at times resembles a field of snow or milk, and Peron asserts that it is often tinged with prismatic colors, varying at every moment; but these phenomena were not witnessed in our voyage.

The strangest of all the modes in which the phosphorescence of the ocean is exhibited, was witnessed near the island of Tristan D'Acunha, under circumstances too impressive to be forgotten.

The night was dark and damp, and the breeze too light to steady the vessel. She rolled heavily over the waves, making it difficult for a landsman to walk the deck. A fog bank, which hung around the northern horizon at sunset, now swept slowly down toward us. The captain ordered the light sails furled in expectation of a squall, and we stood leaning together over the rail, watching the mist, which approached more and more rapidly, till it resembled, in the increasing darkness, an immense wall extending from the water to the clouds, and seemed threatening to crush us beneath it. Just at this moment, a flash, like a broad sheet of lightning, spread itself over the surface of the ocean as far as the eye could reach—five or six times, at intervals of a few seconds, the flash was repeated, and the vessel was enveloped in the fog. The breeze quickened, the bustle of preparation attracted the attention of every one, and in a few moments we were bounding along at the rate of ten miles an hour, over waves sparkling in the clear moonshine; but the "lightning of the waters" had ceased. I have always regretted that I did not ascertain by what animal this most singular phenomenon was produced, but the wild interest of the scene banished every thought of the kind. In the course of the night we passed through several beds of the salpa, and it is very probable that the flashes were produced by these little creatures, induced by a wonderful instinct to act in concert for some inscrutable purpose.

There are few phenomena in nature which have led to a greater diversity of opinion among modern men of science, than the luminous appearance of the ocean during the night. Some have regarded it as the effect of electricity, produced by the friction of the waves; others as the product of a species of fermentation in the water, occurring accidentally in certain places. Many have attributed it to the well known phosphorescene of putrid fish, or to the decomposition of their slime and exuvia, and a few only to the real cause—the voluntary illumination of many distinct species of marine animals, generally of the molluscous tribe. Even those authors who have acknowledged the agency of animal life in producing this wonderful appearance, have been in a manner compelled, by its universality, and by the almost incredible multiplication of beings which it infers, to admit the probable cooperation of other causes.

My own observation has led to the conclusion, that the phosphoresence of the ocean is due sólely to the peculiar instinct of the molluscæ, and some genera of the crustaceæ.

The electrical hypothesis is certainly fallacious, for were we even to grant the possibility of producing an electric light in an agitated fluid, which is itself an imperfect conductor, similar to that occasioned by the attrition of white sugar or glass in the dark, the acknowledged physical law, that like causes produce like effects, would lead us to expect an uniform diffusion of the phosphoresence over a considerable extent of water under the same latitude and longitude; but this is not the case. A ship will often be enveloped for a few moments in so bright an illumination that a book may be read upon the deck, and at the next instant she may be involved in almost total darkness. Again, electricity is eliminated with the greatest facility in a cold and dry atmosphere; but the phosphorescence of the ocean is most considerable in tropical climates, nor is it diminished by storms or rain. The supposition of a fermentation of the surface is equally unsatisfactory, for such a process would lead to an equable diffusion of light over the whole space in which it acted. But the luminous matter is almost always seen in distinct masses or particles; and the few exceptions to this rule which have been observed, do not admit of an explanation according to the known effects of fermentation. The light eliminated by putrid fish furnishes a more plausible theory, but the very wide extent of the illumination, is of itself sufficient to prove its incorrectness. It has been already shown to what an incalculable amount the living inhabitants of the

ocean increase, but the reverse is true of the dead. The air and the water swarm with innumerable depurators, who devour every thing that dies, whether beneath the surface or upon it. The albatross, the stormy petrel, the cape pigeon, some of the gulls, and other marine fowls, which are constantly soaring by thousands every sea, seize upon all unprotected animals, dead or living, which remain within their reach. The three former birds will follow the ship for days during calm weather, to share the offals thrown over by the cook; and so ravenous is their appetite, that they are frequently caught with the hook and line baited with meat, and trolled in the wake of the vessel. I have frequently seen them bathing their feathers in the grease which floats around the refuse of the camboose, and skimming it up with their spoon-shaped bills with every demonstration of pleasure. Those bodies that sink by their gravity fall a prey to the fish, and those that are too minute to attract the attention of the larger animals, are speedily devoured by the molluscæ. Thus the waters are preserved in a high degree of purity, and probably there does not remain sufficient putrescent matter in a cubic league of water to render luminous a cubic yard. In passing over an extent of ocean greater than the whole circumference of the earth, I did not see a single dead animal of any kind.

The purpose for which this phosphorescence is designed, is lost in conjecture; but when we recollect that fish are attracted to the net by the lights of the fishermen, and that many of the marine shells are said to leave their native element to crawl around a fire built upon the beach, are we not warranted in supposing that the animals of which we have been speaking, are provided with their luminous properties, in order to entice their prey within their grasp?

In quitting the subject of the minute animals of the ocean, I should not neglect to refer the curious to three engravings in the volume of plates to the Voyage aux Terres Australes, by Peron and Lesueuer, where may be seen the happiest efforts of the pencil in delineating some of these interesting beings. The work is contained in the Philadelphia library, and will amply repay the trouble of a visit.

For the Advocate of Science.

SOLUTION OF "SCIENTIFIC PROBLEMS."

In the last number of the Advocate, I observed several scientific problems by "P." which I will now attempt to solve.

"1. Why can more force be exerted with a long screw driver than with a short one?"

Answer.—Because the force is more advantageously applied to a long one. With a short instrument, a great deal of the exertion of the hand is applied to keeping it in its place. By using a long instrument, which is not so liable to be thrown out of its place, almost the entire muscular strength of the hand and arm may be directed to the turning of the screw.

"2. Why will water not flow through a pipe under certain circumstances, until it is forced through?"

Answer.—On account of the obstruction which the dry surface of the pipe presents to the passage of the water. Every one has seen the difficulty with which water that has been poured on a dry table makes its way to the edge of the table, and the rapidity with which it runs off when once it has formed a channel. On the same principle the water finds a difficulty in forcing its way along a dry pipe which is laid horizontal or nearly so; so that the water has not much head in it. The idea conveyed by the language of the problem, that the air in the pipe resists the passing of the water, is certainly incorrect.

"3. Why will a body weigh more at the poles, on the flattened part of the earth where it is thinnest, than on the equator where there is more matter to attract it in a perpendicular direction?"

Answer.—It is an established principle of physics, that a body placed on the surface of a solid spherical mass, is attracted by that sphere, precisely as if the whole of the matter of the sphere were collected in one point at its centre of gravity. It follows that the attraction of the earth for any object on its surface is greatest at that point which is nearest the centre of gravity; and consequently at the poles. In propounding this problem, the writer appears to be misled by the idea that the position of the earth's mass acts on a body at the poles in a *lateral* direction; whereas the attraction of every part of the earth is exerted in a direction more or less downwards. The proposition that I first mentioned, admits of a mathematical demonstration which may be found in most of the treatises on the attraction of gravitation. A diagram may be formed, however, to exhibit the reasonableness of the proposition at a glance of the eye.—For this purpose, let the reader cut out of a piece of paper two oval figures of the same form, and then place them together *crosswise*, so that the long diameter of one shall be in a line with the short diameter of the other, and so that the two diameters shall coincide in a point at one end. This point will represent the pole of the earth on one of the ovals, which I will call A, and the equator on the other, which I will call B. Let him now observe those portions of the two figures which do not coincide. These will be three in number, two sections on A and the one on B. Now the force of gravity at the pole is greater than the force of gravity at the equator, by just as much as the force of attraction of the two crescent-shaped segments of it is greater than that of the one of B, exerted at the point above referred to, in the direction of the centre. It is evident that the one section of B is equal in size to both those of A. Hence there is no difference as to quantity of matter. But the section of B is just in the direction of the centre, while those of A are somewhat lateral. This difference in direction, however, is more than counterbalanced by the circumstance of the two sections of A being so much nearer to the object than that of B; according to the law that the force of gravity increases as the square of the distance decreases. Hence, although the two sections of the oval A are *not so* favorably situated as that of B., yet they are so much nearer to the object, that they attract it with more force, and consequently give it more weight.

The remaining problem on the effect of the centrifugal force in lessening the weight of bodies at the equator, requires more space than I can presume to occupy at present. I will explain it if I can at a future time.

BOREAS.

For the Advocate of Science.

CANALS AND RAIL ROADS.

THE communication in the Advocate of Science, over the signature of "Junius," contains one or two statements which I think deserve further examination. The writer remarks in relation to canals and rail roads, that "in respect to economy, travelling by canals is much less expensive," and adduces data which seem to favor that conclusion. The question of economy is certainly one of no trivial concern, and every thing relating to these two rival projects, which involves this question, should be set in its true light.

The statement of "Junius," if I mistake not, is quite at variance with the popular impression, at least as respects rapid travelling; and it appears to me to be at variance with established facts and principles. The cost of transportation, either on a canal or railway, must depend mainly on three things, viz:—the first cost of the way—in other words, the interest; the cost of repairs, and the expense of *power* in propelling loads. That a rail way does not cost *as much* as a canal, in *this* country at least, I suppose is admitted on all hands. I take it to be equally clear that it costs less, *much* less, to keep a railway in repair, than a canal. The relative expense of power in propelling loads depends upon the velocity. The principal resistance on a level railway is friction. This is a constant quantity, or nearly so. That of a canal is of a different character, and *increases* as the square of the velocity. Hence there must be a certain speed at which the two modes would oppose an equal amount of resistance. This I have observed variously stated at from two and a half to four miles per hour. For the present purpose I will put it at four. It is probably below that point. Now at a lower velocity than this the advantage is obviously in favor of the canal; and more and more so as the velocity diminishes. Above that point it preponderates as rapidly in favor of the railway. At twelve miles an hour, the resistance of water is nine times as great as at four miles an hour; and consequently nine times as great as a railway carriage would meet with

That a higher velocity than four miles an hour must be taken as the basis of calculation in the matter of economy at the present day, I need not spend a moment in showing.

On the whole, I think it must be manifest that a rail road *may be made* to afford a cheaper conveyance, particularly for passengers, than a canal. The facts which "Junius" has quoted in relation to the Liverpool and Manchester rail road, I do not think are conclusive in this case. Many of the circumstances of that rail road are very peculiar, and tend to produce very different results from what might be expected, and indeed from what are realized, under other circumstances.

Steamboats.—Another topic to which "Junius" alludes is the new steamboat recently constructed in the state of New York. He speaks of the "runners or buoys" being filled with air, and says that in the case alluded to hydrogen gas was used. I do not know how much consequence "Junius" means to be understood to attach to the circumstance of the air being *confined* there, but I have several times heard it spoken of as being very important. The truth is, the air in those tubes has just as much effect as the air in an open boat has upon the boat. Its being enclosed makes no difference whatever. And as to hydrogen, although it enables a balloon inflated with it, to surmount the denser atmosphere, yet it cannot be expected, by its mere negative power, to do much towards lifting a steamboat out of the water. The use of it, instead of atmospheric air, would be precisely equivalent to lightening the vessel by so much as the difference between a quantity of atmospheric air and hydrogen sufficient to fill the tubes.

The writer says that "an increase of weight on the vessel above will have no other effect than to depress the runners further into the water, without offering any material impediment to their movement." "Junius" is doubtless aware that whether a vessel is set on *runners* or not, it must sink into the water until it displaces a quantity of water precisely equal in weight to that of the vessel with all its appurtenances, and that every pound that is added will cause the vessel to sink so as to displace a pound of water, whatever be the shape of the vessel.

The only advantage of Mr. Burden's boat, I apprehend, is its greatly elongated shape. It matters not, so far as rapid sailing is concerned, whether there are two runners or only one; or whether the runners consist of hollow tubes or of open boats as long as the tubes; or whether the bottom of the boat itself is the runner, provided that in all other respects the same principle of construction be adhered to. L. H. P.

For the Advocate of Science.

The last number of the Advocate of Science contains a table of the quantity of rain which has fallen annually since 1810, at Spring Mill and at Philadelphia. A doubt is expressed by the editor respecting the correctness of the observations, because they differ so much from the result of other observations made at Wilmington. I take the liberty of dissenting from the opinion that it is impossible for such a difference to exist in the quantity of rain at two contiguous places. My reasons for thus dissenting are based on numerous facts which have come under my notice, as I shall presently explain.

For several years past I have observed attentively the quantity of rain at Wilmington, by means of a rain guage. During the last five years, my table compares with that referred to as follows:—

1829,	Philadelphia,	41.85 inches.—	Wilmington,	44.00 inches.
1830,	do.	45.07 "	do.	49.60 "
1831	do.	43.94 "	do.	59.17 "
1832,	do.	39.87 "	do.	50.20 "
1833,	do.	48.55 "	do.	54.92 "
Average for 5 years,		43.856 "	do.	51.638 "

In this table, the quantity of water which fell at Wilmington in the shape of snow is not included. I presume, however, that the snows are taken into the other estimate; and if so the difference will be increased, as follows. Note, that nine inches of light snow, or six or seven of heavy wet snow, make one inch of water. On this account, the quantity of water is not always in proportion to the depth of snow.

There fell at Wilmington in the year

1829,	48.50	inches of snow, or	6.00	inches of water.
1830,	16.00	" "	2.00	" "
1831,	59.22	" "	9.70	" "
1832,	12.50	" "	1.55	" "
1833,	25.00	" "	3.18	" "

Hence it will appear that 20.43 inches of water have fallen in snow during the five years, which added to the rain, gives an annual fall of water at Wilmington for that time of 56 inches, within a trifle. This is twelve inches more than the guage at the Pennsylvania hospital indicates.

Our rains are often partial, especially in summer. On the 15th of August 1833, being at Salem, N. J. twenty miles S.S.E. from Wilmington, I was surprised to find the country suffering with drought, as there had been repeated rains in the northern part of Delaware. On the evening of that day a thunder gust rose, but passed off towards the north without any rain. Returning home the next day, I found the same drought at Delaware city, and was informed that the corn crop was nearly ruined by it in some neighboring districts. No rain had fallen there on the day before. On arriving at New Castle, five miles S.S.E. of Wilmington, I noticed that a few drops only had fallen. About two miles from Newcastle, I came all at once on the track of the gust, and saw plain marks of a very heavy rain. On reaching Wilmington I found an inch of water in my guage. Nearly four inches had fallen here since there had been any rain at Salem, and in the southern part of Delaware.

The summer and fall of 1831 were marked by an excessive quantity of rain at Wilmington. In July there fell 12.07 inches; in August, 11.90, in September, 7.25; in October, 8.00; making 39.22 inches in the four months. According to the hospital guage, only four and a half inches more than this quantity fell in Philadelphia in the whole year. In looking over the table in the Advocate of Science, it will be seen that more rain fell at Wilmington in those four months than in any year from 1810 to 1828 inclusive (as there represented) excepting the three years '14, '20 and '23. Most of the rains which occurred in this period were local, not extending many miles in any direction. During the same time, however, there were very heavy rains in most parts of the northern states, though the cotton crop in some places to the south suffered from drought. On the ninth of July, 1833, the enormous quantity of *three inches fell in less than an hour*. This deluge of rain was hardly felt four miles south of Wilmington.

Settled storms of snow or rain, are also sometimes very limited in their range. I recollect a cloudy day in winter, a few years ago, when the wind was N.E. and there was every appearance of snow. The threatened storm however, blew over. But a day or two afterwards I learned that a short distance below Salem, N. J. it had snowed nearly all day, and the snow was on the ground to the depth of nearly a foot.

Although the situation of Wilmington is favorable to rain, yet it is not favorable to snow. There is nearly always a greater quantity of snow by several inches, ten miles north or north west of us, than here. Our friends from Chester county, sometimes undertake to pay us a sleigh visit, and find themselves aground before they arrive at the end of their journey.

I will probably make some remarks at a future time on the causes of the difference in the quantity of rain at different places. H. G.

MISCELLANIES.

1. *Indian method of flattening the head.*—Adair, in his history of North American Indians, says that the northern savages flatten their heads in divers forms; but it is chiefly the crown of their heads that they depress, in order to render themselves beautiful, according to their own fancy; "for they call us Longheads, by way of contempt." They fix the tender infant on a kind of cradle, when his feet are tilted above a foot higher than a horizontal position; his head bends back into a hole made on purpose to receive it; when he bears the chief part of his weight on the crown of the head, upon a small bag of sand, without being in the least able to move himself.

2. *Method of ornamenting the teeth.*—Marsden informs us that the natives of Sumatra communicate to their teeth a jetty blackness by means of the essential oil of the cocoa nut; and that they even scrape away the enamel, in order to receive and retain the dye more perfectly.

3. *Cause of flat noses in the Negro race.*—Blumenbach seriously quotes an explanation of this peculiarity, which we might suppose his superior intelligence would unhesitatingly ridicule. It is known that the Negroes have a custom of carrying their children on their back. In the violent motions required in their hard labor, as in beating or pounding millet &c. the face of the young one is said to be constantly thumping against the back of the mother, which explains the cause of its flat nose and swollen lip.

4. *Longevity of the Mexicans.*—Humboldt observes that is by no means uncommon to see in Mexico, in the temperate zone, half way up the Cordillera, natives, and especially women, reach 100 years of age. This old age is comfortable, since the Mexican and Peruvian Indians preserve their strength to the last. While he was at Lima, the Indian Hilario Pasi died at the village of Chiguata, at the age of 143. He remained united in marriage 90 years, to an Indian of the name of Andrea Alea Zar, who attained the age of 117. This old Peruvian, at the age of 130, went from three to four leagues daily on foot.

5. *Indian compliment.*—Humboldt informs us that Notlazomahuiztespixcatatzin, is the term of respect used by the Mexicans in addressing the priests. Before seeing this, we thought our own aboriginal names were quite long enough to answer the purpose of "jaw breakers."

6. *Progeny of a wasp's nest.*—Reaumur calculated the number of cells in the comb of a medium sized wasp's nest, to be at least 10,000. This calculation gives an idea of the astonishingly prolific powers of these insects, and the vast number of individuals produced in a single season from one nest; for every cell serves as a lodging for three generations, none containing either wax or honey. Hence a moderately sized nest gives birth annually to 30,000 young wasps.

7. *Enormous increase in size of the queen of the* TERMITES, *or great African ant.*—In a republic of ants exists three grades of personages—the laborers, the soldiers and the gentry, or nobility. The latter alone are capable of being elevated to royalty. Soon after they are born, some destined to become the founders of new states, are seized by the laborers, and immediately inclosed in a chamber, the entrance to which is too small to admit the passage of their prisoner. It is presumed that the female insect alone is thus confined. Soon she undergoes a most extraordinary change. Her abdomen is gradually enlarged to a most enormous size: so that in an old queen it has been found to have increased to 1500 or 2000 times the bulk of the rest of the body, and 20 or 30,000 times the bulk of a common laborer.—*Smellies Phil. Nat. Hist.*

8. *Number of eggs produced by the queen of the African ant.*—The abdomen, which is full of eggs, contained in a vast number of very minute and convoluted vessels, has an undulating motion, by means of which they are protruded in almost incredible numbers, to the amount, as has been pretty accurately calculated, of upwards of 80,000 in twenty-four hours.—*Ibid.*

9. *Hills of the African ant.*—"Of all the extraordinary things I saw," says Adanson, in his voyage to Senegal, "nothing struck me more than certain eminences, which, by their height and regularity, made me take them, at a distance, for an assemblage of Negro huts, or a considerable village; and yet they were only the nests of certain insects. These nests are round pyramids, from eight to ten feet high, upon nearly the same base, with a smooth surface of rich clay, excessively hard and well built." Jobson says, "Some of them are twenty feet in height, of compasse to contayne a dozen of men, which the heat of the sun baked into that hardnesse, that we used to hide ourselves in the ragged toppes of them, when we took up stands to shoot at deere or wild beasts."—*Ibid*

10. *Utility of the stork.*—This bird is held in great veneration among the Africans, on account of its destroying immense numbers of lizards and other noxious reptiles. After an inundation of the Nile, the lower parts of Egypt are greatly infested with serpents, lizards, frogs, mice &c. At this period the storks resort thither in great multitudes, and devour an immense quantity. Belon remarks, that in many places the land could not be inhabited were it not for the labors of this useful bird.

11. *Convenient method of carrying game.*—According to Dampier, the logwood cutters of Campeachy, occupied the seventh day of the week in hunting in the savannas, for bullocks and other game. When a bullock was shot, it was cut up where it lay, divided into quarters and the large bones ta ken out, when each man thrust his head through a portion and trudged home. If the load became too weighty, part was cut off and flung to the wild beasts and birds of prey, which ever prowled and hovered near the hunter.

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